

## HAIR CONDITIONING COMPOSITION COMPRISING THREE KINDS OF SILICONES

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### Cross Reference to Related Application

This application claims the benefit of U.S. Provisional application No. 60/415,597, filed on October 2, 2002.

### Field of Invention

The present invention relates to a hair conditioning composition comprising 3 types of silicones, amidoamines and high melting point fatty compounds. The composition of the present invention can provide improved conditioning benefits such as smoothness and softness.

### Background of the Invention

Human hair becomes soiled due to its contact with the surrounding environment and from the sebum secreted by the scalp. The soiling of hair causes it to have a dirty feel and an unattractive appearance. The soiling of the hair necessitates shampooing with frequent regularity.

Shampooing cleans the hair by removing excess soil and sebum. However, shampooing can leave the hair in a wet, tangled, and generally unmanageable state. Once the hair dries, it is often left in a dry, rough, lusterless, or frizzy condition due to removal of the hair's natural oils and other natural conditioning and moisturizing components. The hair can further be left with increased levels of static upon drying, which can interfere with combing and result in a condition commonly referred to as "fly-away hair", or contribute to an undesirable phenomena of "split ends", particularly for long hair.

A variety of approaches have been developed to condition the hair. A common method of providing conditioning benefit to the hair is through the use of hair conditioning agents such as cationic surfactants and polymers, high melting point fatty compounds, low melting point oils, silicone compounds, and mixtures thereof. Most of these conditioning agents are known to provide conditioning benefits by depositing on the hair. For example, silicone compounds are known to provide conditioning benefits such as softness and smoothness to the hair, by depositing on the hair.

Japanese Patent Laid-open H6-80538 discloses hair cosmetics comprising a high molecular weight silicone, a low molecular weight silicone, a silicone compound containing nitrogen atoms, a liquid crystal forming nonionic amphiphilic compound, and alcohols and/or esters, expecting that the composition provides smoothness, flexibility, dry feeling, and moist  
5 feeling to the hair.

It has been found that; it is still not easy to obtain expected conditioning efficacy, especially conditioning benefits such as softness and smoothness by the composition of Japanese Patent Laid-open H6-80538. It has been found that; it is still not easy to obtain expected  
deposition of silicone compounds by the composition of Japanese Patent Laid-open H6-80538.

10 Based on the foregoing, there remains a desire for hair conditioning compositions which provide improved silicone deposition, thus provide improved conditioning benefits such as softness and smoothness.

There also exists a desire for hair conditioning compositions which provide improved silicone deposition, while not deteriorating other benefits such as slippery feel and slick feel on  
15 wet hair.

There further exists a desire for hair conditioning compositions which provide conditioning benefits such as reduced frizziness, in addition to the above conditioning benefits such as softness and smoothness.

None of the existing art provides all of the advantages and benefits of the present  
20 invention.

#### Summary of the Invention

The present invention is directed to a hair conditioning composition comprising by weight:

- (a) from about 0.1% to about 20% of a silicone system comprising:
  - (i) a first silicone which is non-volatile, substantially free of amino groups, and has a viscosity of from about 100,000mPa·s to about 30,000,000mPa·s;
  - (ii) a second silicone which is non-volatile, substantially free of amino groups, and has a viscosity of from about 1mPa·s to about 10,000mPa·s; and
  - (iii) a third silicone which is an aminosilicone having a viscosity of from about 100mPa·s to about 50,000mPa·s;

- (b) from about 0.1% to about 10% of an amidoamine having the following general formula:



wherein  $R^1$  is a residue of  $C_{11}$  to  $C_{24}$  fatty acids,  $R^2$  is a  $C_1$  to  $C_4$  alkyl, and  $m$  is an integer from 1 to 4;

- (c) an acid selected from the group consisting of l-glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, l-glutamic acid hydrochloride, tartaric acid, and mixtures thereof, at a level such that the mole ratio of amidoamine to acid is from about 1:0.3 to about 1:1.3;
- (d) from about 0.1% to about 20% of a high melting point fatty compound; and
- (e) an aqueous carrier.

The hair conditioning composition of the present invention can provide improved silicone deposition, thus provide improved conditioning benefits such as softness and smoothness. These and other features, aspects, and advantages of the present invention will become better understood from a reading of the following description, and appended claims.

5

#### Detailed Description of the Invention

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the present invention will be better understood from the following description.

Herein, "comprising" means that other steps and other ingredients which do not affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of".

10

All percentages, parts and ratios are based upon the total weight of the compositions of the present invention, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include carriers or by-products that may be included in commercially available materials.

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Herein, "mixtures" is meant to include a simple combination of materials and any compounds that may result from their combination.

#### SILICONE SYSTEM

The hair conditioning composition of the present invention comprises a silicone system comprising following 3 silicone compounds: (i) a first silicone which is non-volatile, substantially free of amino groups, and has a viscosity of from about 100,000mPa·s to about 30,000,000mPa·s; (ii) a second silicone which is non-volatile, substantially free of amino groups,

and has a viscosity of from about  $1\text{mPa}\cdot\text{s}$  to about  $10,000\text{mPa}\cdot\text{s}$ ; and (iii) a third silicone which is an aminosilicone having a viscosity of from about  $100\text{mPa}\cdot\text{s}$  to about  $50,000\text{mPa}\cdot\text{s}$ .

The viscosity can be measured by means of, for example, a glass capillary viscometer as set forth in Dow Corning Corporate Test Method CTM0004, July 20, 1970, which is incorporated by reference herein in its entirety.

It is believed that; the silicone system can provide improved conditioning benefits such as softness and smoothness to both damaged hair and non-damaged hair.

The silicone system is contained in the composition of the present invention at a level by weight of from about 0.1% to about 20%, preferably from about 0.5% to about 10%. Preferably, the silicone system has a viscosity of from about  $500\text{mPa}\cdot\text{s}$  to about  $100,000\text{mPa}\cdot\text{s}$ , more preferably from about  $1,000\text{mPa}\cdot\text{s}$  to about  $50,000\text{mPa}\cdot\text{s}$ .

Preferably, the first and the second silicones are contained at a level such that the weight ratio of the first silicone to the second silicone is preferably from about 1:1 to about 1:10, more preferably from about 1:1 to about 1:6.

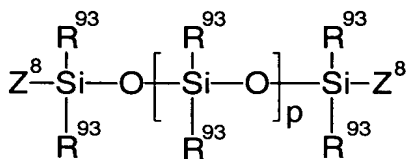
Preferably, the first, the second, and the third silicones are contained at a level such that the weight ratio of the third silicone to the total of the first and the second silicones is from about 1:1 to about 1:20, more preferably from about 1:1 to about 1:10.

#### FIRST SILICONE

The hair conditioning composition of the present invention comprises a first silicone. The first silicone is non-volatile, and substantially free of amino groups. In the present invention, the first silicone being "substantially free of amino groups" means that the first silicone contains 0% of amino groups. The first silicone has a viscosity of from about  $100,000\text{mPa}\cdot\text{s}$  to about  $30,000,000\text{mPa}\cdot\text{s}$  at  $25^{\circ}\text{C}$ , preferably from about  $200,000\text{mPa}\cdot\text{s}$  to about  $30,000,000\text{mPa}\cdot\text{s}$ . The first silicone has a molecular weight of preferably from about 100,000 to about 1,000,000, more preferably from about 120,000 to about 1,000,000. The first silicone compound is preferably nonionic.

The first silicone compound is contained in the composition at a level by weight of, preferably from about 0.1% to about 10%, more preferably from about 0.1% to about 5%.

Preferred first non-volatile silicone compounds useful herein include polyalkyl or polyaryl siloxanes with the following structure:



wherein  $\text{R}^{93}$  is alkyl or aryl, and  $p$  is an integer from about 1,300 to about 15,000, more preferably from about 1,600 to about 15,000.  $\text{Z}^8$  represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain ( $\text{R}^{93}$ ) or at the ends of the siloxane chains  $\text{Z}^8$  can have any structure as long as the resulting silicone remains fluid at room temperature, is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. Suitable  $\text{Z}^8$  groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two  $\text{R}^{93}$  groups on the silicon atom may represent the same group or different groups. Preferably, the two  $\text{R}^{93}$  groups represent the same group. Suitable  $\text{R}^{93}$  groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred silicone compounds are polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. Polydimethylsiloxane, which is also known as dimethicone, is especially preferred. Commercially available these silicone compounds useful herein include, for example, those available from the General Electric Company in their TSF451 series, and those available from Dow Corning in their Dow Corning SH200 series.

The silicone compounds that can be used herein also include a silicone gum. The term "silicone gum", as used herein, means a polyorganosiloxane material having a viscosity at 25°C of greater than or equal to 1,000,000mPa·s. It is recognized that the silicone gums described herein can also have some overlap with the above-disclosed silicone compounds. This overlap is not intended as a limitation on any of these materials. The "silicone gums" will typically have a mass molecular weight in excess of about 165,000, generally between about 165,000 and about 1,000,000. Specific examples include polydimethylsiloxane, poly(dimethylsiloxane methylvinylsiloxane) copolymer, poly(dimethylsiloxane diphenylsiloxane methylvinylsiloxane) copolymer and mixtures thereof. Commercially available silicone gum useful herein include, for example, TSE200A available from the General Electric Company.

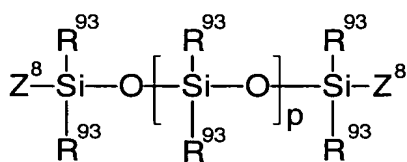
## SECOND SILICONE

The hair conditioning composition of the present invention comprises a second silicone. The second silicone is non-volatile, and substantially free of amino groups. In the present invention, the second silicone being "substantially free of amino groups" means that the second

silicone contains 0% of amino groups. The second silicone has a viscosity of from about 1mPa·s to about 10,000mPa·s at 25°C, preferably from about 5mPa·s to about 5,000mPa·s. The second silicone has a molecular weight of preferably from about 400 to about 65,000, more preferably from about 800 to about 50,000. The second silicone is preferably nonionic. The second silicone is preferably a linear silicone.

The second silicone is contained in the composition at a level by weight of, preferably from about 0.1% to about 17%, more preferably from about 0.4% to about 10%.

Preferred second non-volatile silicone compounds useful herein include polyalkyl or polyaryl siloxanes with the following structure:



wherein  $\text{R}^{93}$  is alkyl or aryl, and  $p$  is an integer from about 7 to about 850, more preferably from about 7 to about 665.  $\text{Z}^8$  represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain ( $\text{R}^{93}$ ) or at the ends of the siloxane chains  $\text{Z}^8$  can have any structure as long as the resulting silicone remains fluid at room temperature, is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. Suitable  $\text{Z}^8$  groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two  $\text{R}^{93}$  groups on the silicon atom may represent the same group or different groups. Preferably, the two  $\text{R}^{93}$  groups represent the same group. Suitable  $\text{R}^{93}$  groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred silicone compounds are polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. Polydimethylsiloxane, which is also known as dimethicone, is especially preferred. Commercially available these silicone compounds useful herein include, for example, those available from the General Electric Company in their TSF451 series, and those available from Dow Corning in their Dow Corning SH200 series.

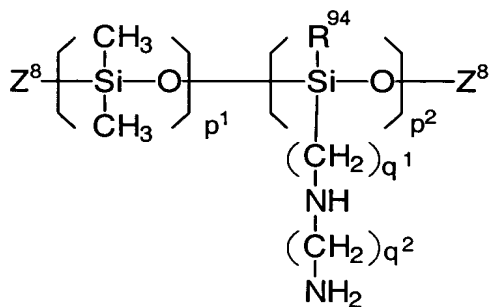
### THIRD SILICONE

The hair conditioning composition of the present invention comprises a third silicone. The third silicone is an aminosilicone having a viscosity of from about 100mPa·s to about 50,000mPa·s at 25°C. The aminosilicone compound has a molecular weight of preferably from about 6,000 to about 110,000. The aminosilicone has an amino equivalent of preferably from

about 500 to about 20,000. In the present invention, the amino equivalent is an integer obtained by following equation: the molecular weight of the aminosilicone divided by the number of nitrogen atoms in the molecule.

The aminosilicone is contained in the composition at a level by weight of, preferably  
5 from about 0.1% to about 10%, more preferably from about 0.1% to about 5%.

Preferred aminosilicones useful herein include alkylamino substituted silicone compounds having the following structure:



wherein  $\text{R}^{94}$  is H,  $\text{CH}_3$  or OH;  $p^1$  and  $p^2$  are integers of 1 or above, and wherein sum of  $p^1$  and  $p^2$   
10 is from 330 to 1,500;  $q^1$  and  $q^2$  are integers of from 1 to 10.  $\text{Z}^8$  represents groups which block the ends of the silicone chains. Preferred  $\text{Z}^8$  groups include, for example, hydroxy, methyl, alkoxy, and aryloxy. More preferred are hydroxy and methyl. Highly preferred are those known as "amodimethicone". Commercially available amodimethicone useful herein includes, for example, BY16-872 available from Dow Corning, and ADM1100 available from Wacker.

#### 15 AMIDOAMINE

The hair conditioning composition of the present invention comprises an amidoamine of the following general formula:



wherein  $\text{R}^1$  is a residue of  $\text{C}_{11}$  to  $\text{C}_{24}$  fatty acids,  $\text{R}^2$  is a  $\text{C}_1$  to  $\text{C}_4$  alkyl, and  $m$  is an integer  
20 from 1 to 4.

The amidoamine is included in the composition at a level by weight of from about 0.1% to about 10%, preferably from about 1% to about 4%.

The amidoamine, together with acids, can function as a cationic surfactant in the composition of the present invention. It is believed that; when used in the composition of the  
25 present invention, amidoamine can provide improved deposition of silicones especially aminosilicones, compared to other cationic surfactants such as stearyl trimethyl ammonium chloride. It is also believed that; the composition of the present invention can provide improved

conditioning benefits such as softness and smoothness due to improved deposition of silicones. It is further believed that; in highly preferred embodiments, the compositions of the present invention can provide reduced frizziness in addition to softness and smoothness.

Preferred amidoamine useful in the present invention includes  
5 stearamidopropyl dimethylamine, stearamidopropyl diethylamine, stearamidoethyl diethylamine, stearamidoethyl dimethylamine, palmitamidopropyl dimethylamine, palmitamidopropyl diethylamine, palmitamidoethyl diethylamine, palmitamidoethyl dimethylamine, behenamidopropyl dimethylamine, behenamidopropyl diethylamine, behenamidoethyl diethylamine, behenamidoethyl dimethylamine,  
10 arachidamidopropyl dimethylamine, arachidamidopropyl diethylamine, arachidamidoethyl diethylamine, arachidamidoethyl dimethylamine, and mixtures thereof; more preferably stearamidopropyl dimethylamine, stearamidoethyl diethylamine, and mixtures thereof.

Commercially available amidoamines useful herein include: stearamidopropyl dimethylamine having tradename SAPDMA available from Inolex, and  
15 tradename Amidoamine MPS available from Nikko, and behenamidopropyl dimethylamine having a tradename IncromineBB available from Croda. Without being limited to the theory, it is believed that behenamidopropyl dimethylamine provides improved tolerance to the hair for humidity in the surrounded circumstance compared to other amidoamines having shorter alkyl chain. It is believed that behenamidopropyl dimethylamine provides reduced frizziness and/or  
20 fly-away in rainy day and/or humid day.

#### ACID

The hair conditioning composition of the present invention comprises an acid selected from the group consisting of L-glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, L-glutamic acid hydrochloride, tartaric acid, citric acid, and  
25 mixtures thereof; preferably L-glutamic acid, lactic acid, citric acid, and mixtures thereof. Preferably, the mole ratio of amidoamine to acid is from about 1:0.3 to about 1:1.3, more preferably from about 1:0.5 to about 1:1.0.

#### HIGH MELTING POINT FATTY COMPOUND

The hair conditioning composition of the present invention comprises a high melting  
30 point fatty compound. The high melting fatty compound, together with the above amidoamine, the above acid, and an aqueous carrier, provides a gel matrix which is suitable for providing various conditioning benefits such as slippery and slick feel on wet hair, and softness, moisturized feel, and fly-away control on dry hair.



The high melting point fatty compound useful herein have a melting point of 25°C or higher, and is selected from the group consisting of fatty alcohols, fatty acids, fatty alcohol derivatives, fatty acid derivatives, and mixtures thereof. It is understood by the artisan that the compounds disclosed in this section of the specification can in some instances fall into more than one classification, *e.g.*, some fatty alcohol derivatives can also be classified as fatty acid derivatives. However, a given classification is not intended to be a limitation on that particular compound, but is done so for convenience of classification and nomenclature. Further, it is understood by the artisan that, depending on the number and position of double bonds, and length and position of the branches, certain compounds having certain required carbon atoms may have a melting point of less than 25°C. Such compounds of low melting point are not intended to be included in this section. Nonlimiting examples of the high melting point compounds are found in International Cosmetic Ingredient Dictionary, Fifth Edition, 1993, and CTFA Cosmetic Ingredient Handbook, Second Edition, 1992.

The high melting point fatty compound can be included in the composition at a level of from about 0.1% to about 20%, preferably from about 1% to about 10%, still more preferably from about 2% to about 8%, by weight of the composition.

The fatty alcohols useful herein are those having from about 14 to about 30 carbon atoms, preferably from about 16 to about 22 carbon atoms. These fatty alcohols are saturated and can be straight or branched chain alcohols. Nonlimiting examples of fatty alcohols include, cetyl alcohol, stearyl alcohol, behenyl alcohol, and mixtures thereof.

The fatty acids useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty acids are saturated and can be straight or branched chain acids. Also included are diacids, triacids, and other multiple acids which meet the requirements herein. Also included herein are salts of these fatty acids. Nonlimiting examples of fatty acids include lauric acid, palmitic acid, stearic acid, behenic acid, sebacic acid, and mixtures thereof.

The fatty alcohol derivatives and fatty acid derivatives useful herein include alkyl ethers of fatty alcohols, alkoxylated fatty alcohols, alkyl ethers of alkoxylated fatty alcohols, esters of fatty alcohols, fatty acid esters of compounds having esterifiable hydroxy groups, hydroxy-substituted fatty acids, and mixtures thereof. Nonlimiting examples of fatty alcohol derivatives and fatty acid derivatives include materials such as methyl stearyl ether; the ceteth series of compounds such as ceteth-1 through ceteth-45, which are ethylene glycol ethers of cetyl alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; the steareth series of compounds such as steareth-1 through 10, which are ethylene glycol ethers of

steareth alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; cetareth 1 through cetareth-10, which are the ethylene glycol ethers of cetareth alcohol, *i.e.* a mixture of fatty alcohols containing predominantly cetyl and stearyl alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; C<sub>1</sub>-C<sub>30</sub> alkyl ethers of the ceteth, steareth, and cetareth compounds just described; 5 polyoxyethylene ethers of behenyl alcohol; ethyl stearate, cetyl stearate, cetyl palmitate, stearyl stearate, myristyl myristate, polyoxyethylene cetyl ether stearate, polyoxyethylene stearyl ether stearate, polyoxyethylene lauryl ether stearate, ethyleneglycol monostearate, polyoxyethylene monostearate, polyoxyethylene distearate, propyleneglycol monostearate, propyleneglycol 10 distearate, trimethylolpropane distearate, sorbitan stearate, polyglyceryl stearate, glyceryl monostearate, glyceryl distearate, glyceryl tristearate, and mixtures thereof.

High melting point fatty compounds of a single compound of high purity are preferred. Single compounds of pure fatty alcohols selected from the group of pure cetyl alcohol, stearyl alcohol, and behenyl alcohol are highly preferred. By "pure" herein, what is meant is that the 15 compound has a purity of at least about 90%, preferably at least about 95%. These single compounds of high purity provide good rinsability from the hair when the consumer rinses off the composition.

Commercially available high melting point fatty compounds useful herein include: cetyl alcohol, stearyl alcohol, and behenyl alcohol having tradenames KONOL series available from 20 Shin Nihon Rika (Osaka, Japan), and NAA series available from NOF (Tokyo, Japan); pure behenyl alcohol having tradename 1-DOCOSANOL available from WAKO (Osaka, Japan), various fatty acids having tradenames NEO-FAT available from Akzo (Chicago Illinois, USA), HYSTRENE available from Witco Corp. (Dublin Ohio, USA), and DERMA available from Vevy (Genova, Italy).

## 25 AQUEOUS CARRIER

The hair conditioning composition of the present invention comprises an aqueous carrier. The level and species of the carrier are selected according to the compatibility with other components, and other desired characteristic of the product.

The carrier useful in the present invention includes water and water solutions of lower 30 alkyl alcohols and polyhydric alcohols. The lower alkyl alcohols useful herein are monohydric alcohols having 1 to 6 carbons, more preferably ethanol and isopropanol. The polyhydric alcohols useful herein include propylene glycol, hexylene glycol, glycerin, and propane diol.

Preferably, the aqueous carrier is substantially water. Deionized water is preferably used. Water from natural sources including mineral cations can also be used, depending on the

desired characteristic of the product. Generally, the compositions of the present invention comprise from about 20% to about 95%, preferably from about 30% to about 92%, and more preferably from about 50% to about 90% water.

#### POLYSORBATE

5           The hair conditioning composition of the present invention preferably contains a polysorbate, in view of adjusting rheology. Preferred polysorbate useful herein includes, for example, polysorbate-20, polysorbate-21, polysorbate-40, polysorbate-60, and mixtures thereof. Highly preferred is polysorbate-20.

10           The polysorbate can be contained in the composition at a level by weight of preferably from about 0.01% to about 5%, more preferably from about 0.05% to about 2%.

#### ADDITIONAL COMPONENTS

15           The composition of the present invention may include other additional components, which may be selected by the artisan according to the desired characteristics of the final product and which are suitable for rendering the composition more cosmetically or aesthetically acceptable or to provide them with additional usage benefits. Such other additional components generally are used individually at levels of from about 0.001% to about 10%, preferably up to about 5% by weight of the composition.

20           A wide variety of other additional components can be formulated into the present compositions. These include: other conditioning agents such as hydrolysed collagen with tradename Peptin 2000 available from Hormel, vitamin E with tradename Emix-d available from Eisai, panthenol available from Roche, panthenyl ethyl ether available from Roche, hydrolysed keratin, proteins, plant extracts, and nutrients; emollients such as PPG-3 myristyl ether with tradename Varonic APM available from Goldschmidt, Trimethyl pentanol hydroxyethyl ether, PPG-11 stearyl ether with tradename Varonic APS available from Goldschmidt, Stearyl  
25           heptanoate with tradename Tegosoft SH available from Goldschmidt, Lactil (mixture of Sodium lactate, Sodium PCA, Glycine, Fructose, Urea, Niacinamide, Inositol, Sodium Benzoate, and Lactic acid) available from Goldschmidt, Ethyl hexyl palmitate with tradename Saracos available from Nishin Seiyu and with tradename Tegosoft OP available from Goldschmidt; hair-fixative  
30           polymers such as amphoteric fixative polymers, cationic fixative polymers, anionic fixative polymers, nonionic fixative polymers, and silicone grafted copolymers; preservatives such as benzyl alcohol, methyl paraben, propyl paraben and imidazolidinyl urea; pH adjusting agents, such as citric acid, sodium citrate, succinic acid, phosphoric acid, sodium hydroxide, sodium carbonate; salts, in general, such as potassium acetate and sodium chloride; coloring agents, such as any of the FD&C or D&C dyes; hair oxidizing (bleaching) agents, such as hydrogen peroxide,

perborate and persulfate salts; hair reducing agents such as the thioglycolates; perfumes; and sequestering agents, such as disodium ethylenediamine tetra-acetate; ultraviolet and infrared screening and absorbing agents such as octyl salicylate; and antidandruff agents such as zinc pyrithione and salicylic acid.

5 Polypropylene glycol

Polypropylene glycol useful herein are those having a weight average molecular weight of from about 200 g/mol to about 100,000 g/mol, preferably from about 1,000 g/mol to about 60,000 g/mol. Without intending to be limited by theory, it is believed that the polypropylene glycol herein deposits onto, or is absorbed into hair to act as a moisturizer buffer, and/or provides  
10 one or more other desirable hair conditioning benefits.

The polypropylene glycol useful herein may be either water-soluble, water-insoluble, or may have a limited solubility in water, depending upon the degree of polymerization and whether other moieties are attached thereto. The desired solubility of the polypropylene glycol in water will depend in large part upon the form (e.g., leave-on, or rinse-off form) of the hair care  
15 composition. For example, a rinse-off hair care composition, it is preferred that the polypropylene glycol herein has a solubility in water at 25 °C of less than about 1 g/100 g water, more preferably a solubility in water of less than about 0.5 g/100 g water, and even more preferably a solubility in water of less than about 0.1 g/100 g water.

The polypropylene glycol can be included in the hair conditioning composition of the  
20 present invention at a level of, preferably from about 0.01% to about 10%, more preferably from about 0.05% to about 6%, still more preferably from about 0.1% to about 3% by weight of the composition.

Low melting point oil

Low melting point oils useful herein are those having a melting point of less than 25°C.  
25 The low melting point oil useful herein is selected from the group consisting of: hydrocarbon having from 10 to about 40 carbon atoms; unsaturated fatty alcohols having from about 10 to about 30 carbon atoms such as oleyl alcohol; unsaturated fatty acids having from about 10 to about 30 carbon atoms; fatty acid derivatives; fatty alcohol derivatives; ester oils such as pentaerythritol ester oils, trimethylol ester oils, citrate ester oils, and glyceryl ester oils; poly  $\alpha$ -olefin oils; and mixtures thereof. Preferred low melting point oils herein are selected from the  
30 group consisting of: ester oils such as pentaerythritol ester oils, trimethylol ester oils, citrate ester oils, and glyceryl ester oils; poly  $\alpha$ -olefin oils; and mixtures thereof,

Particularly useful pentaerythritol ester oils and trimethylol ester oils herein include pentaerythritol tetrakisostearate, pentaerythritol tetraoleate, trimethylolpropane triisostearate,

trimethylolpropane trioleate, and mixtures thereof. Such compounds are available from Kokyo Alcohol with tradenames KAKPTI, KAKTTI, and Shin-nihon Rika with tradenames PTO, ENJERUBU TP3SO.

Particularly useful citrate ester oils herein include triisocetyl citrate with tradename  
5 CITMOL 316 available from Bernel, triisostearyl citrate with tradename PELEMOL TISC available from Phoenix, and trioctyldodecyl citrate with tradename CITMOL 320 available from Bernel.

Particularly useful glyceryl ester oils herein include triisostearin with tradename SUN  
10 ESPOL G-318 available from Taiyo Kagaku, triolein with tradename CITHROL GTO available from Croda Surfactants Ltd., trilinolein with tradename EFADERMA-F available from Vevy, or tradename EFA-GLYCERIDES from Brooks.

Particularly useful poly  $\alpha$ -olefin oils herein include polydecenes with tradenames  
15 PURESYN 6 having a number average molecular weight of about 500 and PURESYN 100 having a number average molecular weight of about 3000 and PURESYN 300 having a number average molecular weight of about 6000 available from Exxon Mobil Co.

#### Cationic polymer

Cationic polymers useful herein are those having an average molecular weight of at least about 5,000, typically from about 10,000 to about 10 million, preferably from about 100,000 to about 2 million.

20 Suitable cationic polymers include, for example, copolymers of vinyl monomers having cationic amine or quaternary ammonium functionalities with water soluble spacer monomers such as acrylamide, methacrylamide, alkyl and dialkyl acrylamides, alkyl and dialkyl methacrylamides, alkyl acrylate, alkyl methacrylate, vinyl caprolactone, and vinyl pyrrolidone. Other suitable spacer monomers include vinyl esters, vinyl alcohol (made by hydrolysis of  
25 polyvinyl acetate), maleic anhydride, propylene glycol, and ethylene glycol. Other suitable cationic polymers useful herein include, for example, cationic celluloses, cationic starches, and cationic guar gums.

#### Polyethylene glycol

Polyethylene glycol can also be used as an additional component. The polyethylene  
30 glycols useful herein that are especially preferred are PEG-2M wherein n has an average value of about 2,000 (PEG-2M is also known as Polyox WSR® N-10 from Union Carbide and as PEG-2,000); PEG-5M wherein n has an average value of about 5,000 (PEG-5M is also known as Polyox WSR® N-35 and as Polyox WSR® N-80, both from Union Carbide and as PEG-5,000 and Polyethylene Glycol 300,000); PEG-7M wherein n has an average value of about 7,000

(PEG-7M is also known as Polyox WSR® N-750 from Union Carbide); PEG-9M wherein n has an average value of about 9,000 (PEG-9M is also known as Polyox WSR® N-3333 from Union Carbide); and PEG-14M wherein n has an average value of about 14,000 (PEG-14M is also known as Polyox WSR® N-3000 from Union Carbide).

## 5 COMPOSITIONS

The hair conditioning composition of the present invention is preferably substantially free of cationic surfactants other than the combination of amidoamines and acids. Such cationic surfactants herein include, for example, stearyl trimethyl ammonium chloride, cetyl trimethyl ammonium chloride, behenyl trimethyl ammonium chloride, and distearyl dimethyl ammonium chloride. In the present invention, “substantially free of cationic surfactants” means that the composition contain 1% or less, preferably 0.5% or less, more preferably 0% of the cationic surfactants other than the combination of amidoamines and acids.

The hair conditioning composition of the present invention is preferably substantially free of anionic compounds. Anionic compounds herein include anionic surfactants and anionic polymers. In the present invention, “substantially free of anionic compounds” means that the composition contain 1% or less, preferably 0.5% or less, more preferably 0% of anionic compounds.

## PRODUCT FORMS

The hair conditioning compositions of the present invention can be in the form of rinse-off products or leave-on products, can be transparent or opaque, and can be formulated in a wide variety of product forms, including but not limited to creams, gels, emulsions, mousses and sprays.

## **EXAMPLES**

The following examples further describe and demonstrate embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the spirit and scope of the invention. Where applicable, ingredients are identified by chemical or CTFA name, or otherwise defined below.

The compositions of the present invention are suitable for rinse-off products and leave-on products, and are particularly useful for making products in the form of emulsion, cream, gel, spray or, mousse.

## [Conditioner]

Components	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6	Ex.7
First silicone compound-1 *1	1.34	0.67	-	0.67	1.34	1.34	0.67
First silicone compound-2 *2	-	-	0.63	-	-	-	-
Second silicone compound-1 *3	2.86	1.43	-	1.43	2.86	2.86	1.43
Second silicone compound-2 *4	-	-	3.57	-	-	-	-
Third silicone compound *5	0.5	0.5	0.5	0.5	0.5	0.5	0.25
Stearamidopropyl dimethylamine *6	2.0	2.0	2.0	2.0	2.0	2.0	2.0
<i>l</i> -Glutamic acid *7	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Cetyl alcohol *8	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Stearyl alcohol *9	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Polysorbate-20 *10	-	-	-	0.2	-	-	-
PPG-34 *11	-	-	-	-	-	0.5	-
Poly- $\alpha$ -olefin oil *12	-	-	-	-	0.5	-	-
Benzyl alcohol	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Kathon CG *13	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Perfume	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Panthenol *14	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Panthenyl ethyl ether *15	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Hydrolyzed collagen *16	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Vitamin E *17	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Octyl methoxycinnamate	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Benzophenone-3	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Acid EDTA	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Deionized Water	q.s. to 100%						

## [Conditioner]

Components	Ex.8	Ex.9
First silicone compound-1 *1	1.34	-
First silicone compound-2 *2	-	0.63
Second silicone compound-1 *3	2.86	-

Second silicone compound-2 *4	-	3.57
Third silicone compound *5	0.5	0.5
Behenamidopropyl dimethylamine *18	2.3	2.3
<i>l</i> -Glutamic acid *7	0.64	0.64
Cetyl alcohol *8	2.5	2.5
Stearyl alcohol *9	4.5	4.5
Polysorbate-20 *10	-	-
Benzyl alcohol	0.4	0.4
Kathon CG *13	0.03	0.03
Perfume	0.25	0.25
Panthenol *14	0.05	0.05
Panthenyl ethyl ether *15	0.05	0.05
Hydrolyzed collagen *16	0.01	0.01
Vitamin E *17	0.01	0.01
Octyl methoxycinnamate	0.09	0.09
Benzophenone-3	0.09	0.09
Acid EDTA	0.1	0.1
Deionized Water	q.s. to 100%	

#### Definitions of Components

- \*1 First silicone compound-1: dimethylpolysiloxane having a viscosity of 500,000mPa·s, available from GE Toshiba
- 5 \*2 First silicone compound-2: dimethylpolysiloxane having a viscosity of 18,000,000mPa·s, available from GE Toshiba
- \*3 Second silicone compound-1: dimethylpolysiloxane having a viscosity of 200mPa·s, available from GE Toshiba
- \*4 Second silicone compound-2: dimethylpolysiloxane having a viscosity of 20mPa·s, available from GE Toshiba
- 10 \*5 Third silicone compound: Amodimethicone having a viscosity of 20,000mPa·s and amino equivalent of 1800, with a tradename BY16-872 available from Dow Corning.
- \*6 Stearamidopropyl dimethylamine: Amidoamine MPS available from Nikko.



- \*7 *l*-Glutamic acid: *l*-Glutamic acid (cosmetic grade) available from Ajinomoto.
- \*8 Cetyl alcohol: Konol series available from Shin Nihon Rika.
- \*9 Stearyl alcohol: Konol series available from Shin Nihon Rika.
- \*10 Polysorbate-20: Glycosperse L-20K available from Lonza Inc.
- 5 \*11 PPG-34: New Pol PP-2000 available from Sanyo Kasei.
- \*12 Poly- $\alpha$ -olefin oil: Puresyn 100 available from Exxon Mobil
- \*13 Kathon CG: Available from Rohm & Haas
- \*14 Panthenol: Available from Roche.
- \*15 Panthenyl ethyl ether: Available from Roche.
- 10 \*16 Hydrolyzed collagen: Peptin 2000 available from Hormel.
- \*17 Vitamin E: Emix-d available from Eisai.
- \*18 Behenamidopropyl dimethylamine: IncromineBB available from Croda

#### Method of Preparation

- 15           The hair conditioning compositions of "Ex. 1" through "Ex. 7" as shown above can be prepared by any conventional method well known in the art. They are suitably made as follows:

Deionized water is heated to 85 °C. Stearamidopropyldimethylamine and L-glutamic acid are mixed with cetyl alcohol and stearyl alcohol. The water is maintained at a temperature of about 85 °C until the components are homogenized, and no solids are observed. The aqueous  
20 carrier is then cooled to about 55 °C and maintained at this temperature, to form a gel matrix. Pre-mixed silicones (mixtures of first, second and third silicone compounds) are added to the gel matrix. When included, poly  $\alpha$ -olefin oils, polypropylene glycols, and/or polysorbates are also added to the gel matrix. The gel matrix is maintained at about 50 °C during this time with constant stirring to assure homogenization. After it is homogenized, it is cooled to room  
25 temperature. When included, other additional components such as perfumes and preservatives are added with agitation. A triblender and/or mill can be used in each step, if necessary to disperse the materials.

The embodiments disclosed and represented by the previous "Ex. 1" through "Ex. 7" have many advantages. For example, they can provide improved conditioning benefits such as  
30 softness and smoothness to both damaged hair and non-damaged hair, while not deteriorating other benefits such as slippery and slick feel on wet hair. They can also provide moisturized feel and fly-away control on dry hair. In highly preferred embodiments, they can also provide conditioning benefits such as reduced frizziness.